HP 8-way ProLiant server technology

technology brief

Abstract

This technology brief describes the technologies that enable the HP ProLiant DL760 G2 and ProLiant DL740 servers to provide the highest levels of intelligent fault-resilience, dynamic scalability, and powerful, 8-way performance.

The intended audience for this paper is engineers and system administrators familiar with existing HP technology and servers. For those less familiar with HP technology, please see the related technology briefs referenced in this document.

Introduction

Today's business critical applications demand ever-increasing scalability and availability from enterprise servers. Because space in enterprise-class data centers is becoming increasingly scarce, customers require servers that provide maximum performance per inch. The 8-way ProLiant DL760 G2 and ProLiant DL740 servers deliver outstanding scalable performance for 24x7 multiserver rack environments. Their high-availability features provide the uptime required to meet the current and future demands of enterprise data center computing.

HP mechanical innovations allow both servers to pack an unprecedented level of power and performance into small form factors. Furthermore, the modular mechanical designs provide tool-free access to server components, and additional serviceability features simplify installation and maintenance.

This technology brief explains the technologies of the ProLiant DL760 G2 and ProLiant DL740 servers that enhance performance, availability, and serviceability. Many of these technologies are described in more detail in separate technology briefs, which are referenced in this document.

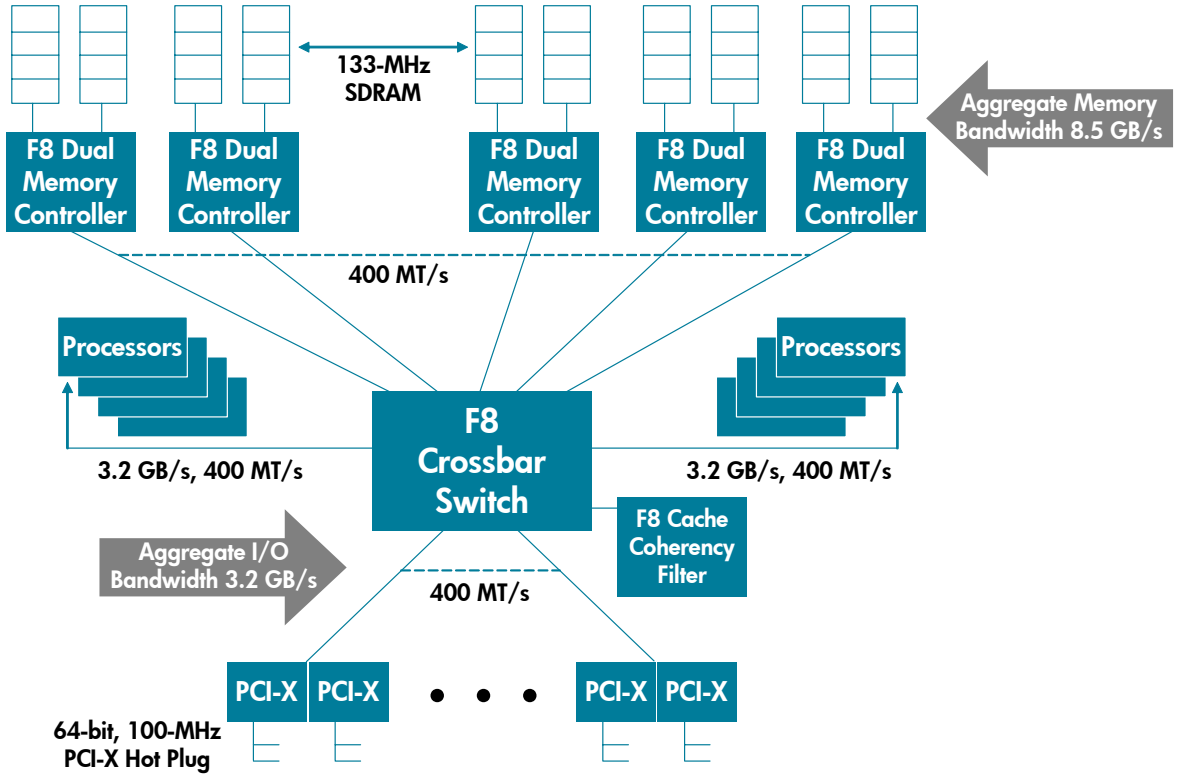
High-performance technologies

The 8-way ProLiant servers are powerful, industry-leading solutions for distributed enterprise computing. For these servers, HP developed the F8 architecture based on Intel® Xeon™ MP processors to deliver high bandwidth and performance for I/O, processor, and memory requirements.

F8 chipset architecture

The backbone of the 8-way architecture is the F8 chipset (Figure 1) designed by HP. It includes five memory controllers with patent-pending HP Hot Plug RAID Memory and a multiported crossbar switch.

Figure 1. Block diagram of the F8 chipset architecture



The F8 chipset supports

- Up to eight Intel Xeon MP processors.
- An aggregate memory bandwidth of 8.5 gigabytes per second (GB/s) using five separate memory controllers, each with 400-megatransfer-per-second (MT/s), point-to-point connections.
- Up to 64 GB of addressable memory using 2-GB DIMMs.
- Hot Plug RAID Memory.
- Independent, nonblocking access to memory, processors, and I/O through the multiported crossbar switch.
- Up to four industry-standard PCI-X bridges, each with an embedded PCI Hot Plug controller.

For more information on the F8 architecture, read *HP F8 Architecture* at http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00257053/c00257053.pdf.

Xeon MP processors

Xeon MP is the multiprocessing version of the Pentium® 4 family of seventh-generation IA-32 processors. The Xeon MP processor is designed for performance in high-end x86 workstations and servers.

The Xeon MP processors use Intel's hyper-threading technology that improves processor utilization to meet the needs of large, memory-intensive server applications. Hyper-threading technology enables one physical processor to execute two separate threads at the same time, and it allows the processor to execute instructions in the order that will yield the best overall performance.

The Xeon MP processor includes a level two (L2) cache located on the same die as the processor logic. The high bandwidth and low latency of the full-speed backside bus enables efficient access to the most frequently used data. The Xeon MP also includes an integrated level three (L3) cache on the die with size options of 2 or 4 megabytes (MB).

The Xeon MP bus operates at 100 megahertz (MHz) using a quad-pumped data rate that provides an effective data transfer frequency of 400 MT/s and a maximum theoretical bandwidth of 3.2 GB/s. In addition, the Pentium 4 instruction set includes 76 new instructions, known as Streaming Single Instruction Multiple Data (SIMD) Extensions 2, which enable higher levels of performance in multimedia applications.

The Xeon MP processor also extends the out-of-order execution model of previous processors, and it employs a new type of cache, called a trace cache, that improves branch prediction. Enhanced out-of-order execution and branch prediction significantly improve processor performance.

Memory subsystem

Probably the most significant improvement in the F8 architecture is the addition of Hot Plug RAID Memory, which increases availability, scalability, and fault tolerance in industry-standard servers. The F8 memory controllers also provide greatly increased memory bandwidth to handle the Xeon MP bus speeds, which are four times greater than previous bus speeds.

The F8 chipset uses five memory controllers designed by HP to control five cartridges of industry-standard PC133 synchronous dynamic random access memory (SDRAM). Within each cartridge, a dual memory controller uses 1.06-GB/s paths into two separate channels of memory. This gives a total bandwidth of 2.12 GB/s within each memory cartridge. Because one memory cartridge is dedicated to storing parity information, the architecture has the effective bandwidth of four memory controllers, or 8.5 GB/s. External to the memory cartridge, the memory controllers interface with the crossbar switch using a 200-MHz, double-pumped, point-to-point connection. Thus, the memory network interface has an effective data transfer rate of 400 MT/s.

The two memory channels are cache-line interleaved; they share a common address range. As a memory controller performs a write transaction, cache lines with even addresses go to one memory channel and cache lines with odd addresses simultaneously go to the other. Cache-line interleaving is advantageous because certain address ranges tend to be accessed more frequently than others, creating "hot spots" in the memory. Interleaving allows the memory controller to split the heavily used locations between the two channels, since roughly half of all accesses will be even and half will be odd.

Each memory controller supports up to eight DIMMs for a maximum usable memory of 64 GB using 2-GB DIMMS.

F8 crossbar switch

One of the key advantages of the F8 architecture is its use of a nonblocking, multiported crossbar switch. This switch allows simultaneous communication among the processors, I/O, and memory for increased processor speeds and peripheral bandwidths. The F8 chipset also includes a cache coherency filter, or cache accelerator, that removes (or filters) unnecessary snoop cycles on the processor buses.

HP engineers designed the F8 crossbar switch to increase bus efficiency. The design includes

- Large, reorganized buffers that can hold 128 cache lines.
- 13 read and 4 write ports to increase the number of transactions that can run concurrently.
- Optimized cross-bus traffic through a patent-pending algorithm to significantly enhance the ability to scale beyond 4-way multiprocessing.

I/O subsystem

HP is a leading technology innovator of industry-standard I/O subsystems, as evidenced by its development of PCI Hot Plug technology, the I/O controller for the Profusion chipset (HP predecessor to the F8 chipset), and codevelopment of PCI-X technology.

HP has used this expertise to help a chipset vendor develop an industry-standard PCI-X bridge that provides a high-performance data path between the F8 chipset and peripheral devices. HP designed the F8 chipset to support up to four of these industry-standard PCI-X bridges using a 200-MHz, double-pumped, point-to-point connection that results in an effective data transfer of 400 MT/s. The point-to-point connection is source synchronous, which means that the clock signal travels with the data signal. Because the clock signal and the data travel together, the risks of signal degradation are minimized and the source signal is always synchronized with the receiver to provide more effective data transmission.

Each PCI-X bridge supports two 64-bit PCI-X bus segments. Each of the eight bus segments can be independently configured to run in PCI mode operating at 33 or 66 MHz or to run in PCI-X mode operating at 66 or 100 MHz. Both modes support PCI Hot Plug using an integrated controller developed and licensed by HP.

High-availability technologies

Tolerance of server downtime continues to decrease as companies become more global, decentralized, and aware of downtime costs. The ProLiant DL760 G2 and ProLiant DL740 servers answer the demand for high availability by incorporating the following features into the server hardware:

- Hot Plug RAID Memory
- PCI Hot Plug technology
- Redundant, hot-plug fans
- Redundant processor power modules (PPMs)
- Redundant, hot-plug power supplies
- Hot-plug drives
- Integrated array controller

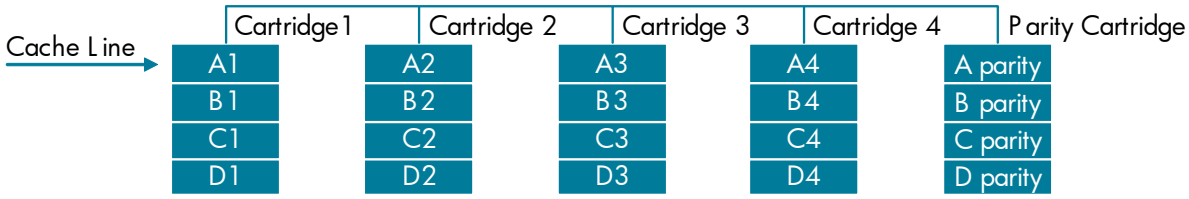
Redundant components help ensure that the server is highly fault tolerant. In redundant configurations, if a power supply, fan, or PPM fails, the redundant standby component can take over operation with no downtime to the server. With the addition of hot-plug capabilities, server downtime can be eliminated while components are being replaced, added, or upgraded.

Hot Plug RAID Memory

Hot Plug RAID Memory allows memory administrators to add, replace, and upgrade memory while the server is running. It also allows the detection of otherwise undetectable memory errors, which provides a level of data protection far greater than parity or ECC solutions. HP Hot Plug RAID Memory enables the memory subsystem to withstand a complete memory device failure and to continue operating normally.

ProLiant servers with Hot Plug RAID Memory technology use five memory controllers to control five cartridges of industry-standard SDRAM. When a memory controller needs to write data to memory, it splits a cache line of data into four blocks (shown as A, B, C, and D in Figure 2). Then each block is written, or striped, across four of the memory cartridges. RAID logic calculates parity information, which is stored on the fifth cartridge. With the four data cartridges and the parity cartridge, the memory subsystem is redundant such that, if the data from any DIMM is incorrect or if any cartridge is removed, the data can be recreated from the remaining four cartridges.

Figure 2. Data striping in Hot Plug RAID Memory



The redundancy in HP Hot Plug RAID Memory provides the ability to hot plug memory cartridges to achieve unprecedented levels of memory availability and scalability within industry-standard servers. Hot Plug RAID Memory enables replacement, addition, and upgrade of DIMMs without shutting down the server.

PCI Hot Plug technology

The ProLiant DL760 G2 and ProLiant DL740 servers incorporate industry-standard PCI Hot Plug technology. This technology adds hot-plug capabilities to existing PCI adapters for increased system availability and serviceability. PCI Hot Plug technology allows the server to control each PCI Hot Plug slot individually, so that a single slot can be powered down without affecting the operation of other slots. PCI Hot Plug technology allows the following capabilities while the system is running:

- Hot replacement – replacing a single PCI adapter with a similar adapter
- Hot upgrade – replacing a PCI adapter with an upgraded adapter
- Hot expansion – adding a PCI adapter to an empty slot

Redundant hot-plug fans

The ProLiant DL760 G2 and ProLiant DL740 servers include redundant hot-plug system fans. One fan is required to cool the system, and the other fan is redundant. If the primary fan fails, a system alert triggers the secondary (or redundant) fan to take over automatically. The redundant hot-plug system fan protects the various server components from overheating and helps prevent possible system interruption.

The fan control logic operates independently from the system processor and operating system (OS). Regardless of which OS is running or its condition, the fan control logic and the server temperature monitoring circuitry work together to cool the server effectively.

The fans have two speeds: normal and high. Under typical operating conditions, the normal fan speed is sufficient to cool a fully loaded server. As a precaution against increases in ambient air or localized internal temperatures, HP established three thermal trip points. If the first thermal trip point is reached, the fans adjust automatically to high speed to increase cooling.

If the internal air temperature exceeds the second trip point, the OS initiates a controlled shutdown of the server. Simultaneously, a warning message is sent to HP Insight Manager and, on the ProLiant DL760 G2 server, to the Integrated Management Display (IMD). The server restarts automatically when it has cooled sufficiently.

Finally, in the unlikely event server temperature continues to rise, a third trip point shuts down the power supplies to protect critical components from overheating. The server restarts automatically when it has cooled sufficiently.

Redundant processor power modules

The processors in the 8-way ProLiant servers have redundant PPMs, also known as voltage regulator modules. The PPMs deliver the precise voltage required by the processors.

HP PPMs are programmable and support all current and future versions of Xeon MP processors. Each PPM has redundant circuitry. If a failure occurs in one circuit of the module, the other circuit automatically takes over the task of regulating power to the processor.

Redundant hot-plug power supplies

The 8-way ProLiant servers use intelligent, redundant, hot-plug power supplies to reduce downtime. The ProLiant DL760 G2 server supports two dual-rated 1150-watt/500-watt power supplies, while the ProLiant DL740 server supports two dual-rated 1100-watt/800-watt power supplies. Even if one of these power supplies fails, its internal fans will continue to operate and help cool the server. A single power supply running at 220 volts can support a fully loaded server, but a second power supply adds redundancy and fault tolerance.

The power supplies communicate their status back to the system health drivers. The heath drivers then send status information to the Integrated Management Display and to Insight Manager.

In addition, the power supplies also provide:

- **Auto line sensing.** Because the power supplies are dual rated, a line-sensing feature automatically recognizes which line voltage is connected. The customer does not need to configure the supply for voltage.
- **LED standby controls.** Two status light-emitting diodes (LEDs) on the power supply indicate power status. This gives the user vital status information at a glance.

Load balancing

The power supplies automatically load balance to within 10 percent of the average current of all supplies. Before the power comes up, the master power supply matches its output load rails to those of the other power supplies so that the load is automatically balanced across all power supplies. If one supply fails, the load balancing feature allows the other supplies to pick up the remaining power load quickly.

Power factor correction

HP's intelligent power supplies have built-in power factor correction to synchronize the voltage and current phases. This helps ensure that maximum power is available. It also reduces the return current in the ground line, which reduces the overall power consumption.

Hot-plug capability

When a power supply is hot swapped, the microcontroller governs the power-up and power-down sequence, enables the health drivers to calculate redundancy "on the fly," and informs the health drivers of changes in load. HP hot-plug power supplies are readily identifiable by their port-colored bezel.

Hot-plug hard disk drives

The 8-way ProLiant servers each support four 1-inch, Wide Ultra3 SCSI, internal hot-plug hard disk drives. The internal drives can be controlled in either of two ways: by an embedded Smart Array controller to optimize them for OS and boot support or by an optional array controller inserted into one of the PCI slots of the server. When configured for maximum capacity, the servers can support up to 587.2 GB of internal storage.

Integrated array controller

Both servers are also equipped with an embedded Smart Array 5i controller. The integrated controller is an embedded hardware-based RAID solution that enhances system reliability and improves host processor utilization. It is ideal for data center servers in which internal storage is optimized for operating systems and swap space.

RAID implementation enhances data integrity and recovery through data striping and parity generation for the data rebuild process. The integrated array controller improves host processor utilization by performing all RAID functions, thus freeing the host processor for other tasks. The controller is fully integrated and embedded on the motherboard of the servers, which improves I/O efficiency and frees a PCI slot for another controller. The integrated controller can also queue tasks and data, thereby increasing performance.

The integrated controller consists of a processor, memory controller and hardware exclusive-OR (XOR) engine, SCSI chip, PCI bridge, and an internal bus structure embedded on a single substrate. The controller has fewer parts than typical array controllers, since all of the components and connections are combined into one integrated circuit. Having fewer parts leads to greater reliability and increases mean time between failures.

The integrated array controller includes a 16-MB read-only memory with an 8-MB read-ahead cache. This memory configuration is optimal for OS and boot support. Since the memory is read only, data loss is not an issue and battery backup is not required.

System administrators can bypass the integrated array controller by using the Integrated Array Bypass Kit and an optional controller, such as the Smart Array 5312 controller.

Configuration utilities

The Option ROM Configuration for Arrays Utility is firmware that comes with the integrated controller in the 8-way ProLiant servers. This firmware allows users to set up a simple configuration during POST. The support includes the ability to create a single logical drive, delete a single existing logical drive, view the current configuration, and assign an online spare as part of the logical drive creation process. Administrators can configure the integrated controller to initialize as an intelligent I/O processor supporting either dual-channel SCSI operation or RAID.

For more advanced configuration support, HP provides the Array Configuration Utility. It is an easy-to-use graphical configuration utility to help users set up and change drive array configurations. It can be used to configure the standard internal drive controller and any optional controller boards that are installed.

RAID support

The integrated array controller supports RAID levels 0, 1, 0+1, and 5 to ensure data integrity and availability. When configured for RAID 5, and prior to any possible drive failure, the controller proactively generates parity data so that it can keep all data available and the server running during replacement of any failed drive. The integrated array controller also supports online spare disk drives. These spares are powered up but not active; they are held in reserve in case one or more of the active drives should fail.

The controller supports logical drive expansion, which consists of three different types of operations: capacity expansion, RAID migration, and distribution factor changing. Capacity expansion allows growing an existing logical drive, either by adding additional physical drives or by using existing free space on the current physical drives. RAID migration allows changing the RAID level of an existing logical drive. Distribution factor changes the amount of data stored on each physical drive in a RAID stripe. All of these operations can be performed without disturbing the data on the drives.

Management technologies

Fault-tolerant, redundant features are only part of what makes ProLiant servers highly available. HP offers a range of hardware- and software-based server management tools that can be used to reduce downtime and increase productivity. The 8-way ProLiant servers include standard tools available to all ProLiant servers, such as Automatic Server Recovery, System Partition Utilities, Insight Manager, and Asynchronous Insight Management.

In addition to these standard utilities, the 8-way ProLiant servers also ship with management technologies that reduce downtime and increase productivity even more. Remote-flash Redundant ROM allows administrators to update the ROM remotely, and the auto-default ROM configuration provides default configuration settings for most devices. The IMD and IRC provide essential information at a glance and allow users easy remote access to their servers. For additional remote management functionality, the ProLiant DL740 server includes Integrated Lights-Out (iLO) capability and customers can configure ProLiant DL760 G2 servers with the optional Remote Insight Lights-OutII.

Automatic Server Recovery

Automatic Server Recovery (ASR) automatically resets the server after a critical hardware or software error. ASR can reset the server to the OS or to the System Partition Utilities. The ASR reset function is based on a hardware timer working in conjunction with the Server Health Drivers. If the Server Health Drivers can no longer reset the hardware timer after some user-specified amount of time, the server is automatically reset. ASR can also be configured to page the administrator when an ASR event occurs.

System Partition Utilities

System Partition Utilities assist the system administrator in diagnosing server problems, configuring new hardware, and upgrading ROMs. For example, an administrator can analyze the system configuration files to verify that no interrupts or other conflicts are causing system failures. The System Partition Utilities are available when the server is reset. ASR can be configured to reset automatically to the System Partition Utilities, or the administrator can reboot to the System Partition Utilities through Insight Manager.

HP Insight Manager 7 and HP Systems Insight Manager

HP Insight Manager 7 and HP Systems Insight Manager help maximize system uptime and performance and reduce system maintenance costs by providing proactive notification of problems before they result in unplanned downtime or reduced productivity. HP Systems Insight Manager is HP's next-generation web-based enterprise management console. It combines the strengths of Insight Manager 7, HP Toptools, and HP Servicecontrol Manager to provide a single tool for managing ProLiant, Integrity, and HP 9000 systems running Microsoft® Windows®, Linux®, or HP-UX operating systems.

The core Systems Insight Manager software delivers the essential capabilities to manage all HP server platforms. Systems Insight Manager can also be extended to deliver an unparalleled breadth of device management with plug-ins for HP clients, storage, power, and printer products. Plug-ins for rapid deployment, performance management, partition management, and workload management allow systems administrators to pick the value-added software required to deliver complete lifecycle management of their hardware assets.

HP Systems Insight Manager brings together in one location all fault, performance, and management information about the IT infrastructure. By integrating current enterprise management technology with the latest advances in web technology, it enables IT administrators to monitor and manage groups of servers, clients, clusters, and networking products from a standard web browser. HP Systems Insight Manager is capable of discovering and managing devices from HP and other vendors using SNMP, DMI, and HTTP. It logs alerts from these devices, and it sends email or pager notifications of alerts to the appropriate person based on the assigned roles and responsibilities of the IT staff.

Insight Manager 7 and HP Systems Insight Manager are both easy to set up. They work with the Insight Management Agents, Integrated Light-Out, and Version Control Agents to deliver robust fault, configuration, and asset management as well as remote administration. With HP Systems Insight Manager, customers will also be able to take advantage of role-based security, server rapid deployment, performance management, and workload management. For more details on HP Systems Insight Manager please see www.hp.com/go/hpsim.

More information about Insight Manager 7 is available at http://h18004.www1.hp.com/products/servers/management/im/index.html.

Asynchronous Insight Management

Asynchronous Insight Management provides access to Insight Manager through a dial-up networking, or asynchronous, connection. This gives an administrator additional flexibility in troubleshooting problems. If the server OS is still functioning, an administrator can dial in remotely and access Insight Manager through a point-to-point protocol (PPP) connection.

Remote-flash Redundant ROM

The 8-way ProLiant servers are equipped with a Remote-flash Redundant ROM that improves manageability. Using the Remote ROM Flash Utility, administrators can flash the system ROMs for a wide range of ProLiant servers, locally or across the network. The Remote ROM Flash Utility is a combination of components that allows administrators to upgrade the system ROMs on servers from a single point of execution. The ROM upgrades can either be flashed individually or batched together to perform multiple ROM upgrades in a single step.

Remote-flash Redundant ROM provides a unique redundancy feature that helps ensure system availability. During the ROM flash process, it is possible for a problem to occur. Typically, a failure during the ROM flash would shut down the server and require the administrator to replace the ROM. This could be a significant problem if, for example, the flash were scheduled for a time when the administrator was unavailable. Theoretically, the server could be down for hours until the administrator became available to manage the situation. Remote-flash Redundant ROM enables the system to recover the last known good system ROM, in the event that the current system ROM becomes corrupted.

When an 8-way ProLiant server leaves the factory, both system ROMs contain the same image. Through subsequent boots of the server, if the boot block detects integrity errors, the system will automatically launch the redundant image and continue the POST process. If the redundant ROM is launched, the user will see an error message identifying the faulty system ROM.

Auto-Default ROM Configuration

When an 8-way ProLiant server is first powered on, the system ROM detects the unconfigured state of the hardware and provides default configuration settings for most devices. By providing this initialization, the system can run Diagnostics and other software applications before running the normal SmartStart and System Configuration applications.

If the user inserts a System Configuration, Diagnostics, or SmartStart CD in the CD-ROM drive before powering on the server, the system ROM will boot using that CD. If the system ROM does not detect one of these CDs, the user will be prompted for the intended OS. The system will reboot if any OS-dependent configurations have changed with the new OS selection. If the selected OS-dependent configurations match the current configurations, the system will boot normally. Users can change the OS selection during subsequent reboots.

Integrated Management Display

The ProLiant DL760 G2 server includes the IMD, which is a backlit liquid crystal display that allows administrators to enter server and contact information. Just as importantly, the IMD delivers critical information, warning messages, and error messages in an easy-to-understand format.

A 5-volt auxiliary power line supplies power to the IMD whenever the server power line is plugged in. Even if the server power goes down, the auxiliary line continues to power the IMD so that critical information, such as the last error message and the administrator's name, can be obtained.

The IMD unit contains its own static memory. This memory contains the software code to control the IMD and the text messages shown on the display. All software enhancements added in the future will be available through a flashable ROMPaq. During POST, all event logs, system information, and administrator information are uploaded from the system nonvolatile RAM. During runtime, new events are stored in the nonvolatile RAM and the IMD SRAM. If the IMD unit is removed and replaced, all key event and system information is still available.

Integrated Remote Console

Integrated Remote Console (IRC) allows out-of-band, or asynchronous, management capabilities such as remote console and remote reset. These capabilities are independent of the state of the network OS. With IRC, an administrator has full text mode video and keyboard access to the server to perform diagnostics, reset the system, watch the reset process remotely, and view reset sequences, regardless of whether the OS is functional.

Lights-out functionality

The ProLiant DL740 server includes Integrated Lights-Out capabilities to increase availability and improve performance. Integrated Lights-Out, the newest generation of HP Lights-Out technology, consists of an intelligent processor and firmware that provide standard and advanced levels of Lights-Out functionality.

Basic system board management functions, diagnostics, and essential Lights-Out functionality are provided as standard components of ProLiant servers with iLO functionality. The standard features of iLO are referred to as iLO Standard. Advanced functionality of the HP iLO, referred to as iLO Advanced, can be licensed with the optional ProLiant Essentials Integrated Lights-Out Advanced Pack. iLO Advanced offers sophisticated virtual administration features for full control of servers in dynamic data centers and remote locations.

The key iLO Standard features include the following:

- Browser interface – provides easy access, configuration, and setup in Linux and Windows environments
- Virtual power – enables full remote control of the server power button
- Remote text console – enables operating system-independent text-based console to display and control remote host server activities such as shutdown and start-up
- Virtual serial port – enables iLO console access to management applications, such as Windows Server 2003 Emergency Management Services, that are configured for serial port use
- SSL encryption – provides security for all HTTP data transmitted between iLO processors and client browsers
- iLO and server diagnostics – provide detailed status, logs, and alert forwarding for iLO and server
- Group administration – enables administrator user accounts, network and global settings, and activation of the iLO Advanced Pack license keys on large groups of iLO processors simultaneously

Serviceability features

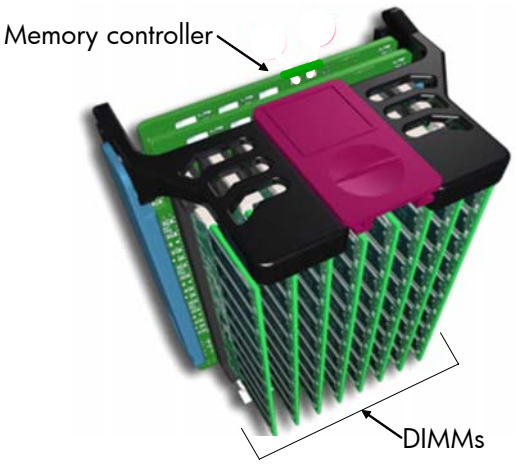
The 8-way ProLiant servers continue the trend of tool-free serviceability started in previous generations of ProLiant servers. Both servers use unique modular designs with removable, drawer-like modules and power supplies that connect to a common system board. The virtually cable-free designs ease serviceability and future upgrades, since a module can be removed and replaced with little effort. The modularity of the servers allows technicians to empty the chasses to eliminate heavy lifting. Cam levers allow easy removal of each module, and four lift assist handles simplify rack mounting the chassis.

Both servers use an innovative processor brick designed by HP that allows easy access and simplifies replacement. Each processor brick supports four processors connected to a processor board with embedded voltage regulators that provide redundant processor power. Each server can support two processor bricks, or up to eight processors. The processor bricks are easily accessed from the top of both servers. The heat sink is coupled with the processor, and the design includes guide pins on the bottom of the processors to make replacement simple and tool-free.

Both servers include a highly serviceable Hot Plug RAID Memory subsystem. The ProLiant DL760 G2 server uses five memory cartridges that are easily accessed from the front of the server (Figure 3) to provide advanced memory protection. The ProLiant DL740 server includes an innovative, double-decker memory board design that provides compact storage for up to 64 GB of memory while allowing easy access for inserting DIMMs. One half of each board houses a memory controller and its associated voltage regulators, while the other half accommodates up to eight 2-GB DIMMs. (See Figure 4.)

Figure 3. The ProLiant DL760 G2 server includes five accessible memory cartridges.

Figure 4. The ProLiant DL740 server uses a double-decker memory board design.



Status LEDs (Figure 5) throughout both servers improve serviceability and further reduce downtime associated with upgrades and field maintenance. The status indicators are visible from the exterior of the servers and communicate the current status of varying aspects of the components and operations. The LEDs include:

- System power LED
- System interconnect LEDs
- System attention LEDs
- System activity LEDs
- Hot-plug SCSI hard drive LEDs
- Power supply LEDs
- Hot-plug fan LEDs
- PCI Hot Plug LEDs
- Memory cartridge LEDs
- DIMM status LEDs

Figure 5. System interconnect, system attention, and system activity LED indicators on the ProLiant DL740 server

In addition to the status indicators, the 8-way ProLiant servers also include hood labels and ink printing throughout the server to simplify component identification and provide easy instructions for common procedures.

Conclusion

The HP ProLiant DL740 and ProLiant DL760 G2 servers offer customers high-performance, highly scalable solutions for their data center needs. The servers also provide all the high-availability features customers have come to expect from HP servers. In addition, HP has integrated key management technologies and revolutionary serviceability features that further reduce downtime and improve manageability.

For customers needing greater performance, availability, and scalability in the data center, the 8-way ProLiant servers are an excellent choice. Development of these servers demonstrates HP's commitment to provide industry-standard servers that exceed customer expectations. As business requirements become more demanding, HP will continue to deliver servers that meet those requirements and can be expanded to meet future needs.

For more information

http://h18004.www1.hp.com/products/servers/platforms/index-dl.html

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